Lori Glaze

NASA Planetary Science Division Town Hall

March 19, 2020

New PSD Management Personnel

Eric Ianson
Deputy Director PSD

Joan Salute
Associate Director for Flight Programs

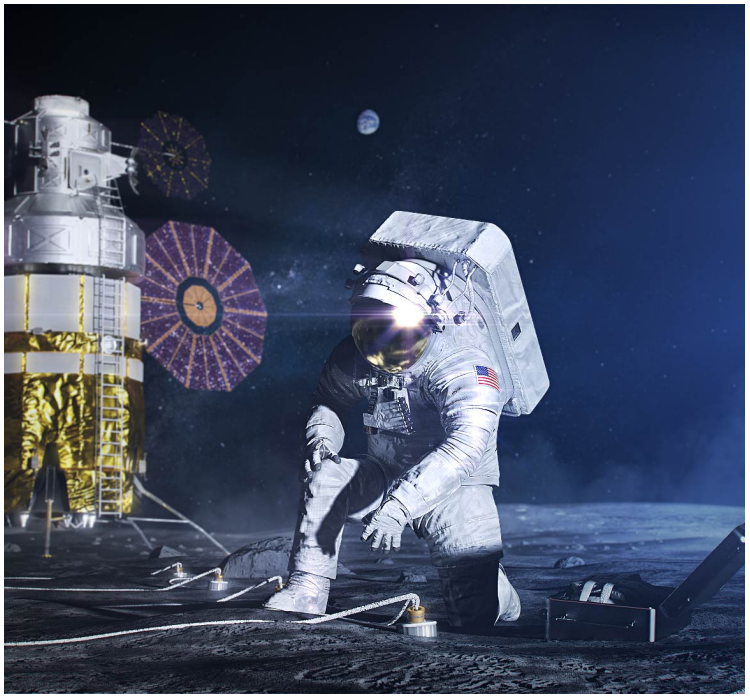
Stephen Rinehart
Director of Planetary R&A Programs

Meagan Thompson
Deputy Director of Planetary R&A Programs

BUDGET

Science Mission Directorate

FY21 Budget Agency Highlights



- One of the strongest budgets in NASA's history, investing more than $25 billion dollars for America's future in space; funding proposed represents an increase of about 12% over last year's request

- Keeps the agency on track to land the first woman and the next man on the Moon by 2024, and with the support of the Gateway, helps prepare for human exploration of Mars

- Budget supports decadal priorities such a Mars Sample Return mission, Europa Clipper, and development of new Earth observation missions

FY21 SMD Budget Strategy

Support Artemis

Implement a Balanced and Integrated Science Program

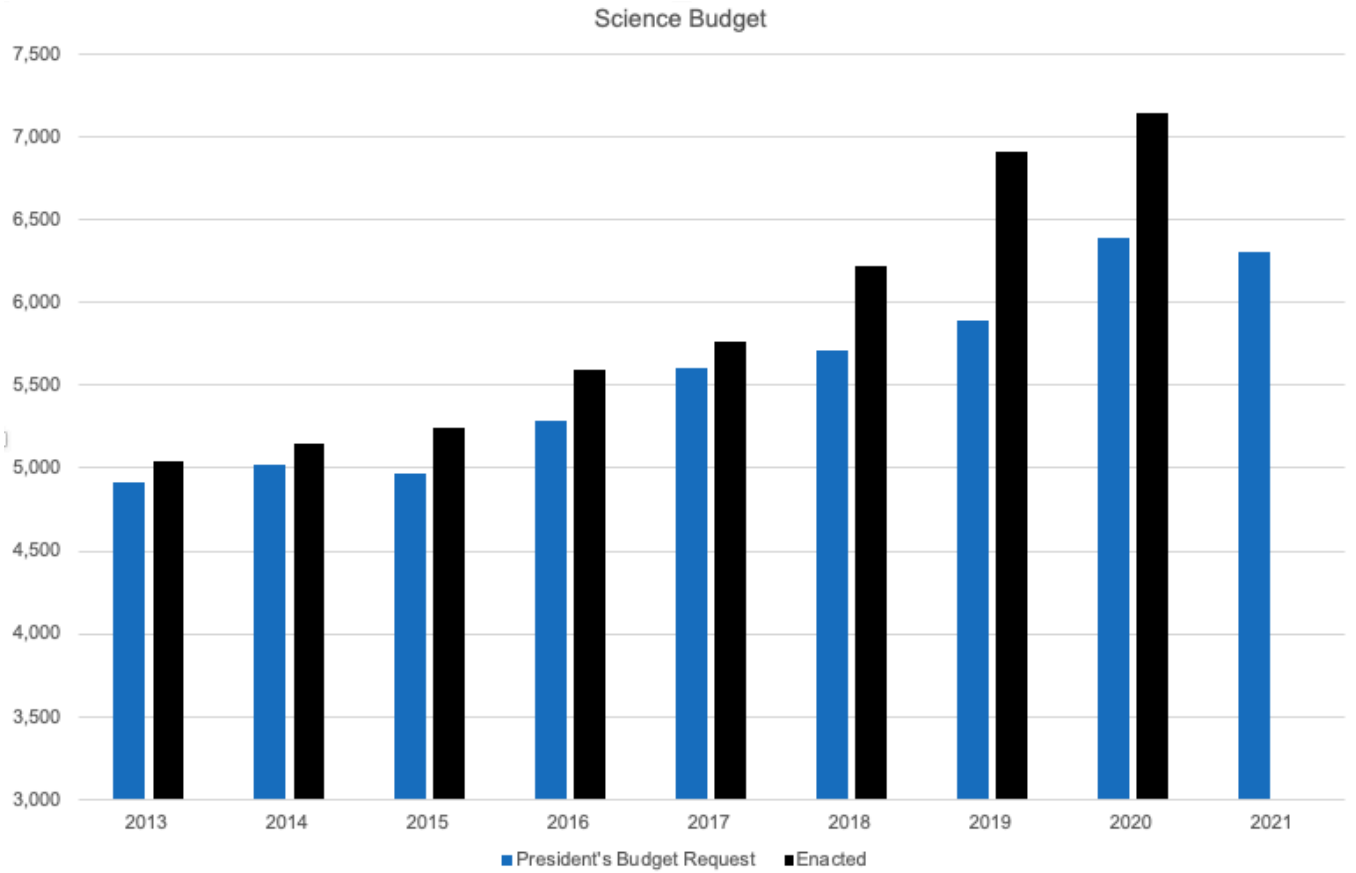
Advance Compelling Science Program with Highest National Priorities

Execute Innovative Partnerships

Science Budget Request Summary ($M)

	Actual FY 19	Request FY 20	Enacted FY 20	Request FY 21	Out-years FY 22	FY 23	FY 24	FY 25
Science	**6,886.6**	**6,393.7**	**7,138.9**	**6,306.5**	**6,553.5**	**6,575.7**	**6,705.2**	**6,766.9**
Earth Science	**1,931.0**	**1,779.8**	**1,971.8**	**1,768.1**	**1,878.2**	**1,846.1**	**1,834.5**	**1,984.6**
Earth Science Research	454.1	447.9		447.3	471.9	494.1	528.5	530.3
Earth Systematic Missions	932.7	719.2		608.3	706.1	695.6	640.7	797.3
Earth System Science Pathfinder	223.8	275.4		338.9	301.2	251.6	241.8	234.4
Earth Science Data Systems	202.0	214.4		245.4	259.9	263.2	278.7	277.7
Earth Science Technology	63.4	69.6		74.2	82.8	84.6	86.4	86.4
Applied Sciences	55.1	53.3		53.9	56.3	57.0	58.5	58.5
Planetary Science	**2,746.7**	**2,712.1**	**2,713.4**	**2,659.6**	**2,800.9**	**2,714.9**	**2,904.8**	**2,830.7**
Planetary Science Research	276.6	266.2		305.4	288.6	285.1	295.2	286.7
Planetary Defense	150.0	150.0	160.0	150.0	147.2	97.6	98.0	98.0
Lunar Discovery and Exploration	188.0	300.0	300.0	451.5	517.3	491.3	458.3	458.3
Discovery	409.5	502.7		484.3	424.4	434.8	570.1	505.8
New Frontiers	93.0	190.4		179.0	314.3	332.8	326.9	285.0
Mars Exploration	712.7	546.5	570.0	528.5	588.4	671.2	798.7	855.3
Outer Planets and Ocean Worlds	793.6	608.4		414.4	370.7	239.4	192.3	171.7
Radioisotope Power	123.3	147.9	147.9	146.3	150.1	162.8	165.4	169.8
Astrophysics	**1,191.1**	**844.8**	**1,306.2**	**831.0**	**891.2**	**1,000.9**	**959.7**	**975.5**
Astrophysics Research	222.8	250.7		269.7	279.1	327.2	314.9	331.1
Cosmic Origins	222.8	185.3		124.0	123.2	120.0	122.4	122.4
Physics of the Cosmos	151.2	148.4		143.9	160.8	155.3	169.8	154.1
Exoplanet Exploration	367.9	46.4		47.2	50.4	47.6	51.6	52.2
Astrophysics Explorer	226.5	214.1		246.2	277.7	350.8	301.0	315.6
James Webb Space Telescope	**305.1**	**352.6**	**423.0**	**414.7**	**175.4**	**172.0**	**172.0**	**172.0**
Heliophysics	**712.7**	**704.5**	**724.5**	**633.1**	**807.8**	**841.8**	**834.1**	**804.1**
Heliophysics Research	248.9	237.0		230.5	218.7	225.2	224.0	224.5
Living with a Star	135.3	107.6		127.9	134.5	246.4	225.5	233.3
Solar Terrestrial Probes	180.5	177.9	183.2	126.3	262.2	202.6	195.6	115.5
Heliophysics Explorer Program	147.9	182.0	182.0	148.4	192.4	167.6	189.0	230.8

Science President's Budget Request and Enacted



Science Mission Directorate

Planetary Science

Planetary Science Budget Features

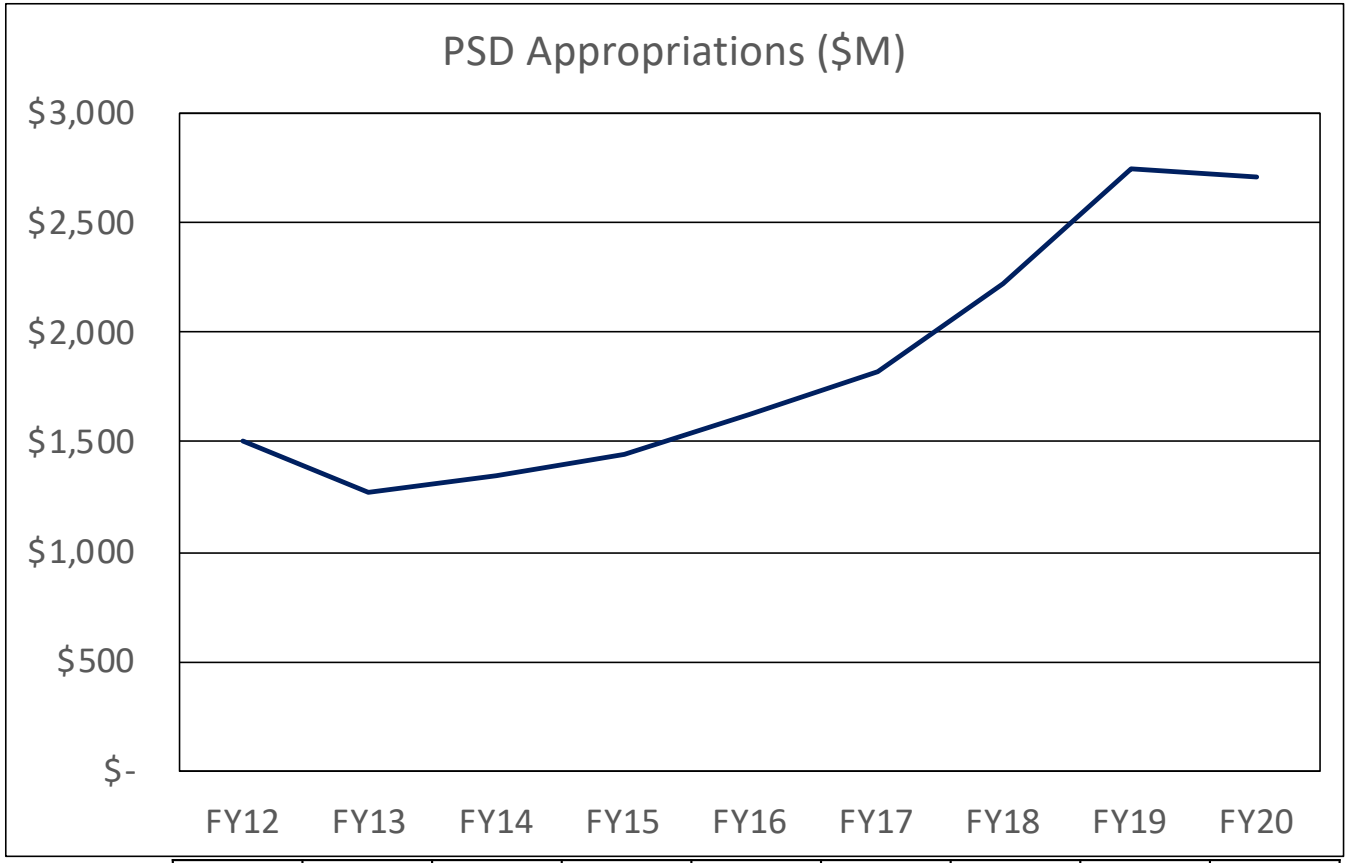
What's Changed

- Proposes Clipper launch in 2024 on a commercial vehicle, which saves over $1.5 billion and makes an SLS available to support an Orion launch to the Moon
- Dragonfly selected as next New Frontiers mission with launch readiness date in 2026
- Increases Commercial Lunar Payload Services based on awards to date
- Increases SmallSat future opportunities within the Discovery Program
- Increases R&A to maintain adherence to Decadal recommendation
- Begin Ice Mapper planning with international and commercial partners

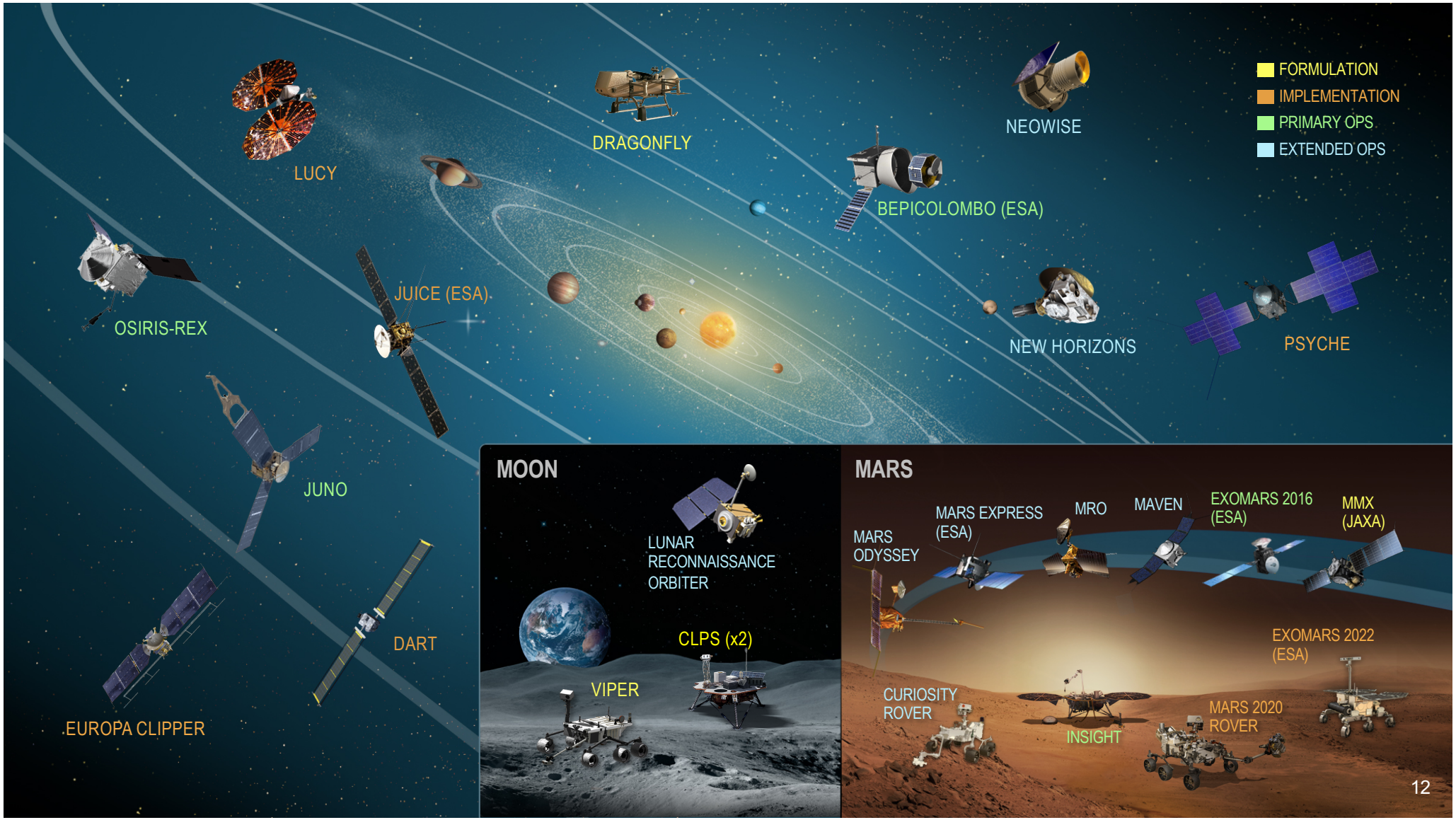
What's the Same

- Enables a Mars Sample Return launch in 2026
- Implements Mars 2020, DART, Dragonfly, Psyche and Lucy as well as instruments on ExoMars 2020, JUICE and MMX
- Enables Discovery selection(s) in 2021 and New Frontiers 5 AO release in 2022
- No funding for Europa Lander
- Maintains Nation's radioisotope power system capability

PSD Appropriations (FY12– 20)



FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
$1,501	$1,272	$1,343	$1,447	$1,628	$1,828	$2,218	$2,747	$2,713


FORMULATION
IMPLEMENTATION
PRIMARY OPS
EXTENDED OPS
LUCY
DRAGONFLY
NEOWISE
BEPICOLOMBO (ESA)
OSIRIS-REX
JUICE (ESA)
NEW HORIZONS
PSYCHE
JUNO
DART
EUROPA CLIPPER
MOON
LUNAR RECONNAISSANCE ORBITER
CLPS (x2)
VIPER
MARS
MARS ODYSSEY
MARS EXPRESS (ESA)
MRO
MAVEN
EXOMARS 2016 (ESA)
MMX (JAXA)
EXOMARS 2022 (ESA)
CURIOSITY ROVER
INSIGHT
MARS 2020 ROVER

PSD OPPORTUNITIES

Planetary Science Advisory Committee (PAC)

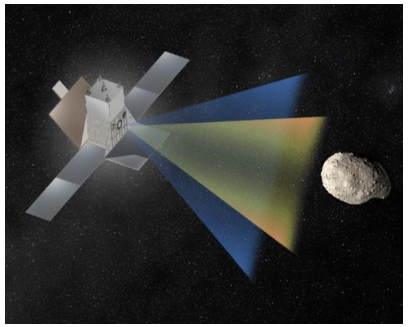
- Self nominations to become member of the Planetary Science Advisory Committee (PAC) are open until End of March 2020
- Information required as part of each self-nomination package:

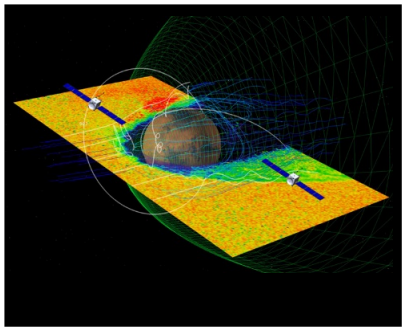
  (1) a cover email including the name, phone number, full mailing and email address of the nominee;

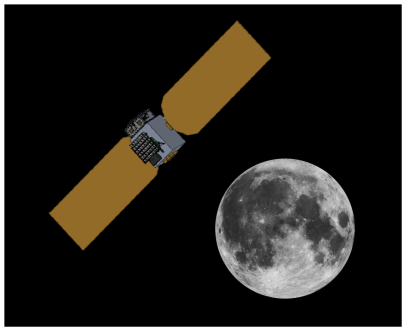
  (2) a professional resume (one-page maximum, included as an attachment); and,

  (3) a professional biography (one-page maximum; included as an attachment).
- Email to the Executive Secretary of the Planetary Science Advisory Committee at pac-execsec@hq.nasa.gov

Announcements of Opportunity







Small Innovative Missions for Planetary Exploration (SIMPLEx)

- Three missions selected for Phase A/B development
- Currently capturing lessons learned through PDR for consideration during next cycle
- Release of next opportunity planned for NET Sep 2020

New Frontiers #4

- Dragonfly selection announced June 27, 2019

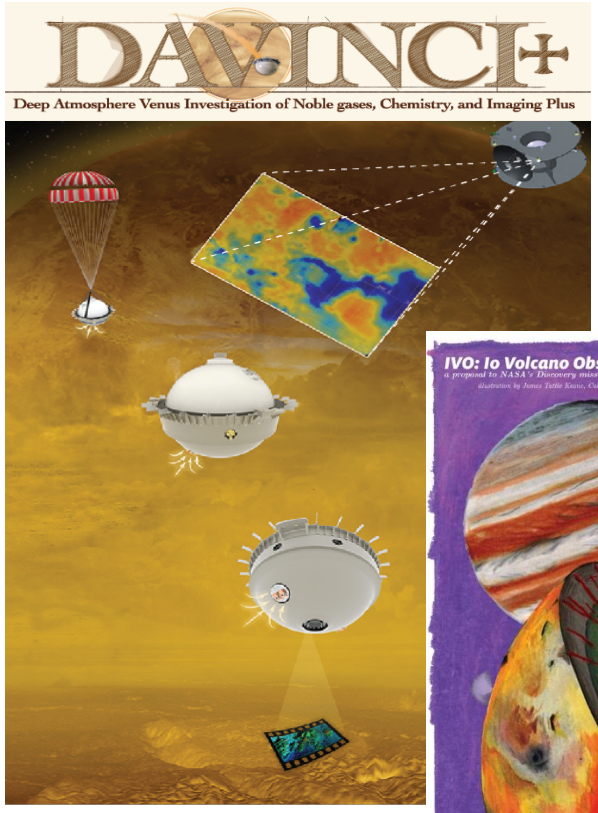
New Frontiers #5

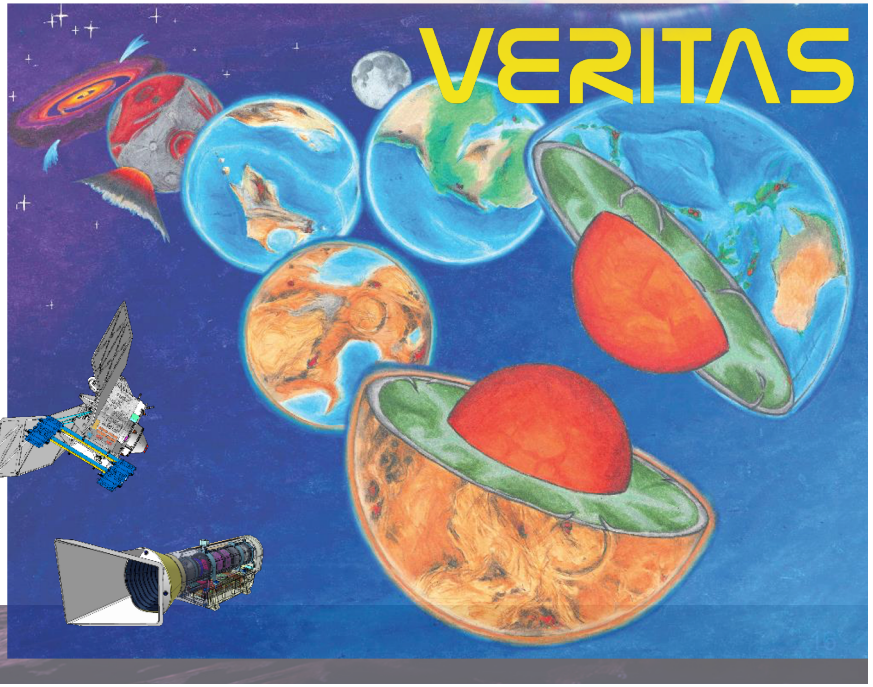
- To be released Fall 2022 (current schedule)

Discovery 2019

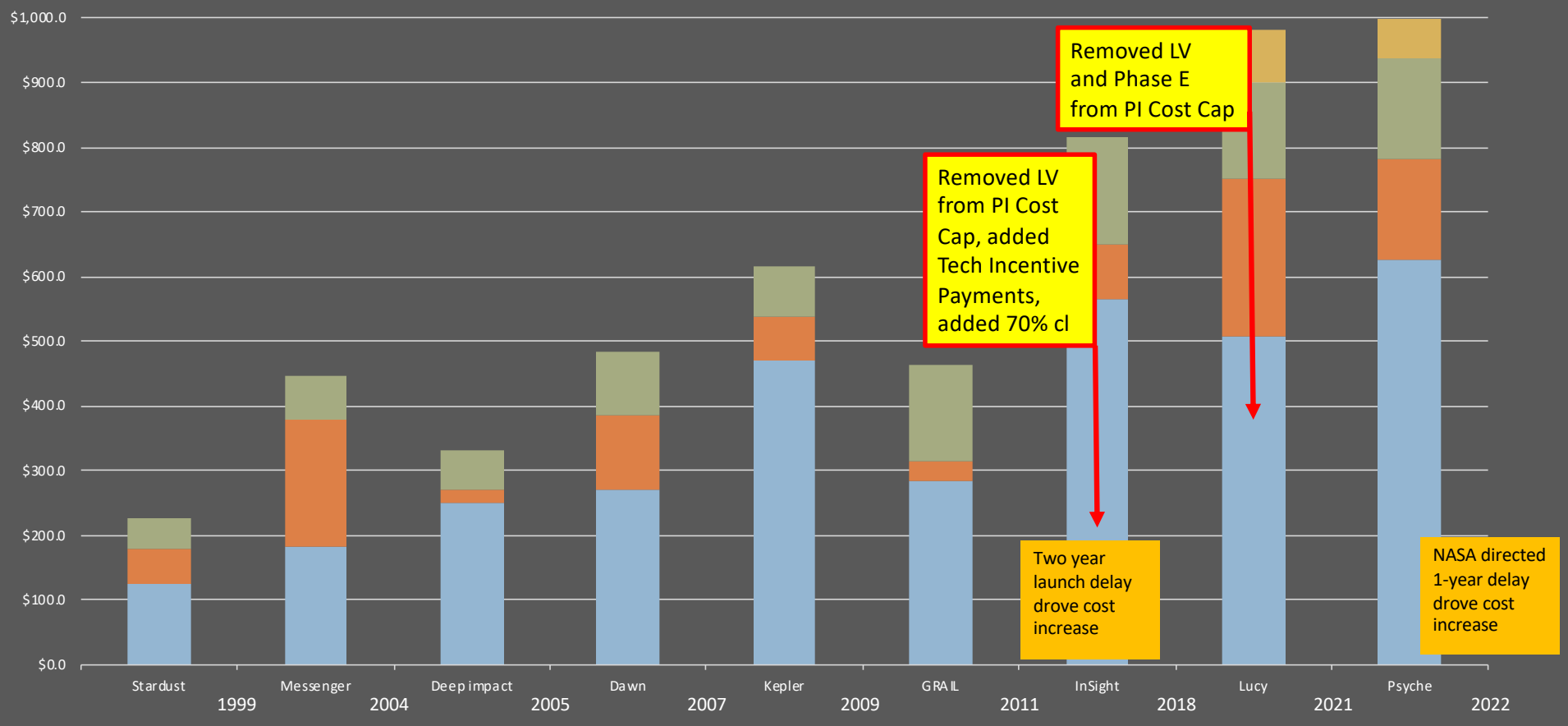
- Step-1 proposals were due July 1, 2019, with selections announced February 13, 2020
- Step-2 selections planned for NET April 2021

Four Discovery Selections for Phase A





Discovery Cost Growth* Resulting From Strategic Decisions (RY $)



*Cost data from CADRE

LOOKING AHEAD

Community Groups (the AGs)

The Analysis/Assessment Groups (AGs) are community-based groups that serve an important role in providing analyses and feedback for specific topic areas.

We are exploring how to better work with the community through these groups by:

- Making Terms of Reference for all groups consistent, with specific differences to reflect the needs of individual communities.
- Provide more consistent funding support to the AG Chairs, with transparency and clear guidelines on acceptable use.
- Provide a clear path for feedback both directly to NASA PSD and through the PAC.
- Target date for this by June 2020.

Preparing for the Next Decadal Survey

- Information on the Planetary Decadal survey can be found at: www.nas.edu/planetarydecadal
- White Paper process will be led by the NAS Space Studies Board (SSB)
- LPI and AG websites are open for community collaborations

https://www.lpi.usra.edu/decadal_whitepaper_proposals/index.cfm

- Upcoming Activities
  - Early Career Workshop (March 27 @ 1pm EDT, see NAS website)
  - PMCS status workshop (Postponed until late April)
  - LPSC Town Hall led by NAS/SSB (held March 16 @ 1:00pm, EDT)

Notional Timeline for 2023 Decadal Survey

2019		
	September	Organizing meeting and town hall at EPSC-DPS
	October	Draft statement of task received from NASA
	November	LPI launches white paper proposal web site
	December	Town hall at AGU meeting
2020		
	January	National Academies posts Statement of Task
	February	Funding proposal to NASA, NSF agree to support
	March	Early-career event and town hall at LPSC
	Spring	White paper submission begin, chair announced
	Summer	White paper deadline and meetings begin
2021		
	Autumn	Complete draft of survey report assembled
2022		
	Spring	Survey report released, dissemination starts
2023		End of dissemination/NASA contract

Conflict of Interest Statement

Prospective members of all National Academies' committees and panels have their financial relationships reviewed to prevent actual or perceived conflicts of interest. Additionally, the National Academies evaluates whether each prospective member is a strong, publicly known advocate for a specific project—broadly defined as a plan, mission, initiative, architecture, or the equivalent—that the committee or panel may evaluate. Such evaluation is necessary to avoid possible bias or a perception thereof.

Nominations and self-nominations to the decadal survey committee—i.e., the steering group and supporting panels—are welcome. Nominees with the following characteristics are encouraged:

- *Scientific and technical expertise, and objectivity;*
- *Experience in the management of a project, organization, or equivalent enterprise is desirable;*
- *Must be broad thinkers, open-minded, and not active proponents of a specific project; and*
- *Be able to participate in-person in survey committee activities.*

Conflict of Interest Statement – Continued

Additional considerations include the following:

- *All authors of science-focused whitepapers prepared for the survey are eligible to be considered as members of the steering group and its supporting panels;*

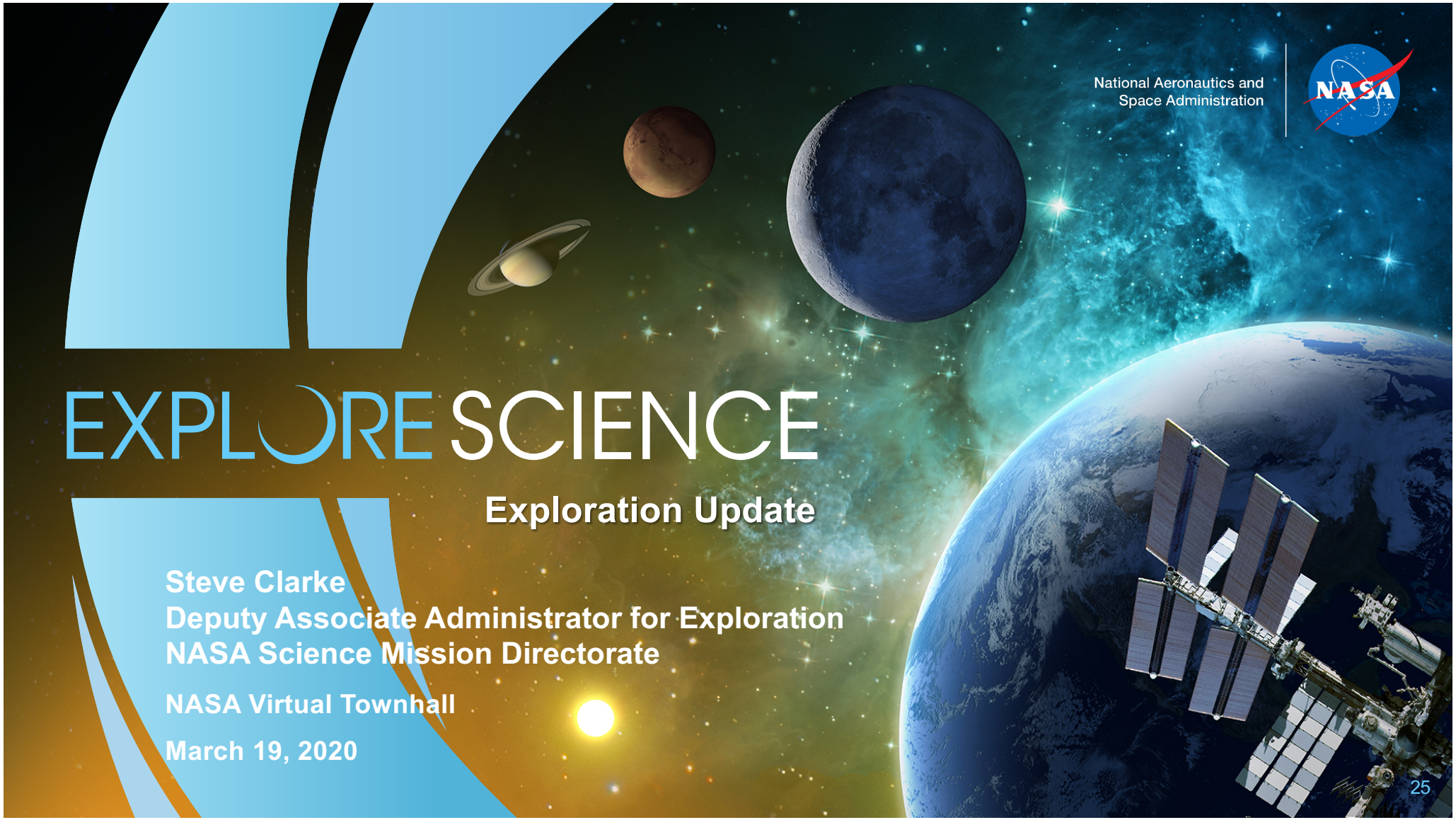
- *First authors of mission-focused whitepapers prepared for the survey cannot serve on the steering group or on any panel considering that mission; and*

- *Principal Investigators of the NASA-funded, pre-decadal mission-concept studies to be evaluated by the survey cannot serve on the steering committee or on any panel considering that mission.*

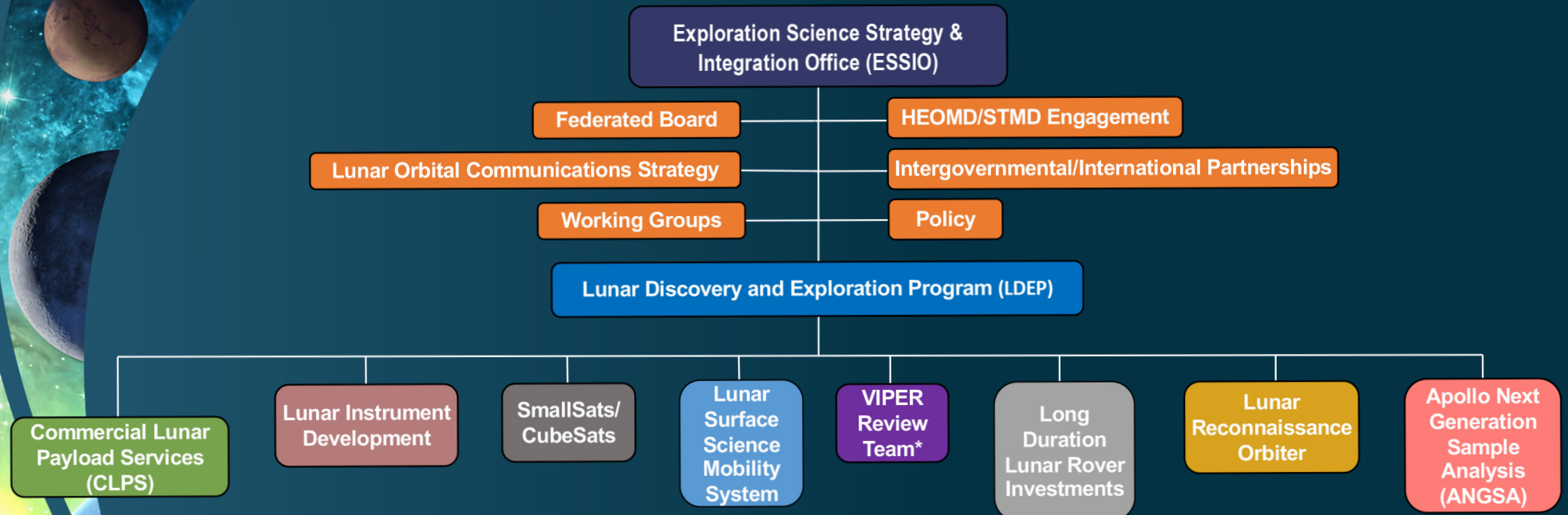
First “PI Launchpad”

LAUNCHPAD
TUCSON, AZ
NOVEMBER 18-20 2019

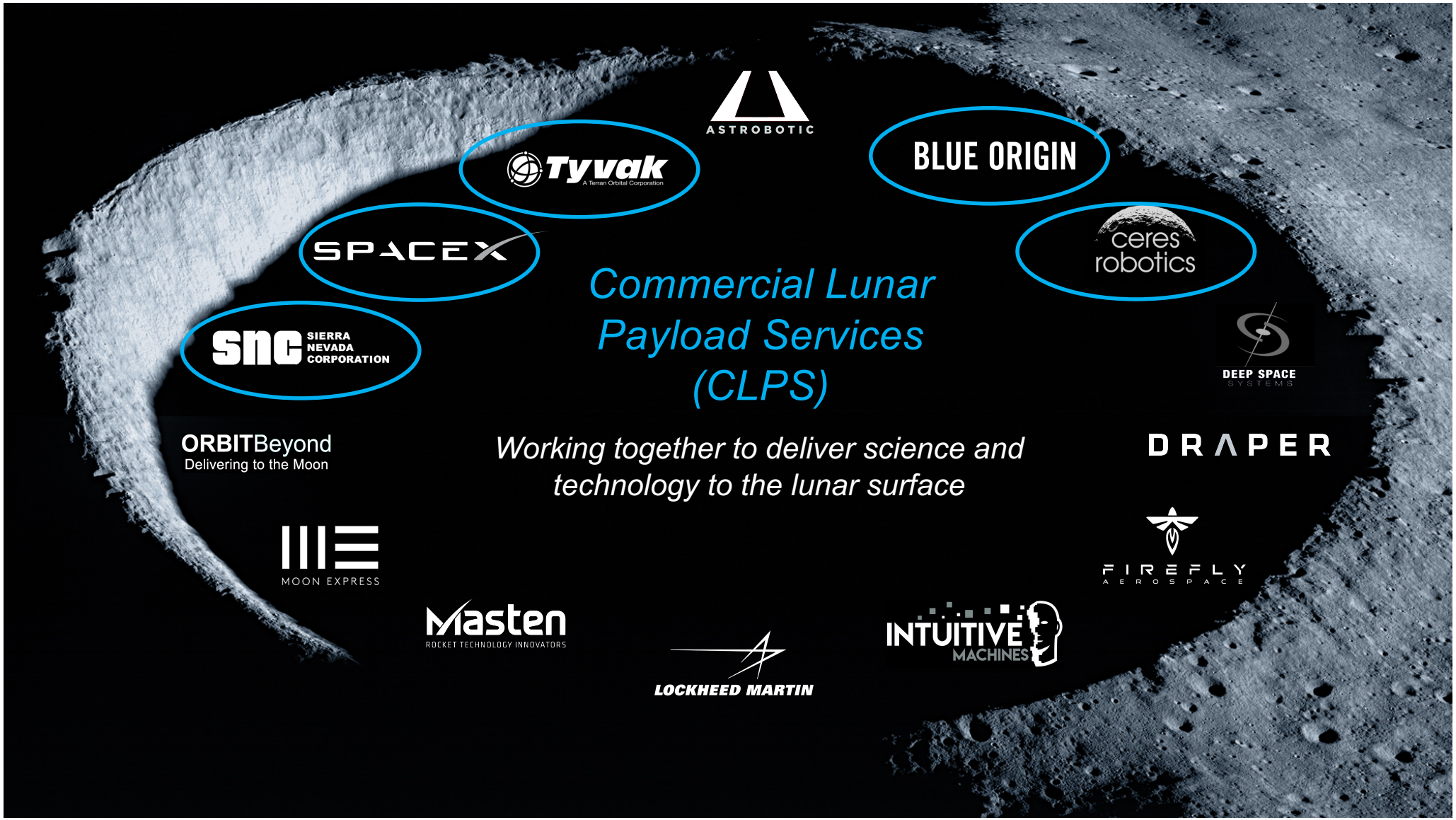
- Aimed at researchers and engineers who would like to submit a NASA space mission proposal in the next few years but don’t know where to start.
- Two-and-a-half day, interactive workshop held in Tucson, AZ on Nov. 18-20, 2019.
- Very competitive application process. Selected ~40 participants. All costs paid for thanks to a grant from the Heising-Simons Foundation to our partner, the University of Arizona.
- Goals:
  - Lead participants from science question to draft requirements, STM, *etc.*
  - Provide first exposure to how to choose partners, assemble teams, *etc.*
  - Provide networking opportunities with mission managing organizations, spacecraft providers and each other.
- Targeting Later Summer 2020 at the University of Michigan for the next Launchpad.


National Aeronautics and
Space Administration
NASA
EXPLORE SCIENCE
Exploration Update
Steve Clarke
Deputy Associate Administrator for Exploration
NASA Science Mission Directorate
NASA Virtual Townhall
March 19, 2020
25

Exploration Science Strategy & Integration Office (ESSIO) Portfolio



*Viper Development funding remains in LDEP and is managed by PSD


ASTROBOTIC
Tyvak
A Terran Orbital Corporation
BLUE ORIGIN
SPACEX
ceres robotics
Commercial Lunar Payload Services (CLPS)
SNC SIERRA NEVADA CORPORATION
DEEP SPACE SYSTEMS
ORBITBeyond
Delivering to the Moon
Working together to deliver science and technology to the lunar surface
DRAPER
MOON EXPRESS
FIREFLY AEROSPACE
Masten
ROCKET TECHNOLOGY INNOVATORS
INTUITIVE MACHINES
LOCKHEED MARTIN

Commercial Lunar Payload Services (CLPS) Summary

- **Task Order 2 - Astrobotic (NPLP + HEO/STMD in-line tech demos)**
  - Lunar delivery September 2021
- **Task Order 2 – Intuitive Machines (NPLP + STMD in-line tech demo + STMD data buy)**
  - Lunar delivery October 2021
- **Task Order 19C (LSITP + NPLP 2nd's)**
  - Will deliver LSITP payloads and some NPLP second copies to a lunar pole in late 2022.
  - Request for Task Order Proposal (RFTOP) proposals received March 4; Selection by the end of March.
- **Task Order 20A (VIPER)**
  - RFTOP released February 25 with proposals due April 10 and award late mid/late May.
    - Delivery lunar surface delivery to late-2023 with a mid-2023 accelerated option.
- **Task Order 19D (Second LSITP)**
  - Will deliver additional payloads from LSITP and tech demos to a non-polar location in early 2023.
  - RFTOP release planned for June/July 2020 timeframe.

2021 CLPS Delivery Manifests

Payloads largely selected from NASA Provided Lunar Payloads (NPLP)

Astrobotics Lander

- Surface Exosphere Alterations by Landers (SEAL)
- Photovoltac Investigation on Lunar Surface (PILS)
- Near-Infrared Volatile Spectrometer System (NIRVSS)
- Mass Spectrometer Observing Lunar Operations (Msolo)
- PROSPECT Ion-Trap Mass Spectrometer for Lunar Surface Volatiles (PITMS)
- Linear Energy Transfer Spectrometer (LETS)
- Neutron Spectrometer System (NSS)
- Neutron Measurements at the Lunar Surface (NMLS)
- Fluxgate Magnetometer (MAG)
- Navigation Doppler Lidar for Precise Velocity and Range Sensing (NDL)

Key

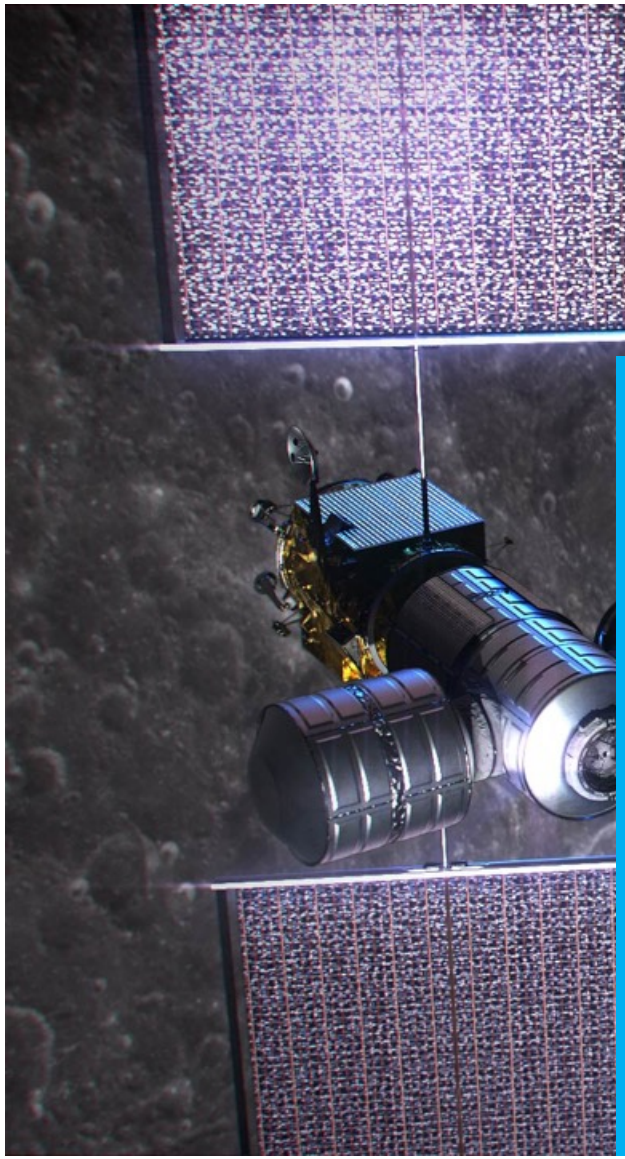
- Science
- Technology
- Exploration
- HEOMD/STMD

Intuitive Machines Lander

- Lunar Node 1 Navigation Demonstrator (LN-1)
- Stereo Cameras for Lunar Plume-Surface Studies (SCALPSS)
- Low-frequency Radio Observations from the Near Side Lunar Surface (ROLSES)
- Navigation Doppler Lidar for Precise Velocity and Range Sensing (NDL)
- Radio Frequency Mass Gauge (RFMG)

PRISM Overview

- Future Payloads and Research Investigations on the Surface of the Moon (PRISM) solicitation planned approximately annually with a 2-stage process
  - Stage 1 - Open RFI expected in March 2020
  - Stage 2 – NRA solicitations will state the location for each delivery, allowing PIs to propose science optimized for those locations
- PRISM Open RFI will result in a catalog of available instruments that will aid in determining future landing sites for CLPS deliveries.
- Initial priority is to solicit suites of instruments that can work together
  - High-value 'location agnostic' instruments also welcome
- Selected PRISM instruments will feed the CLPS manifests from 2023 onwards
  - International payloads, and payloads from other NASA mission directorates also could be incorporated into the Task Order
- The PRISM Open RFI also will create a catalog of instruments from which we can choose to fill out other flight opportunities, either commercial or international
- Expect to have Participating Scientist Programs for each flight
- Future PRISM calls will ask for destination agnostic and stand-alone instruments, in addition to instruments for network science on a campaign of landers



Gateway Science

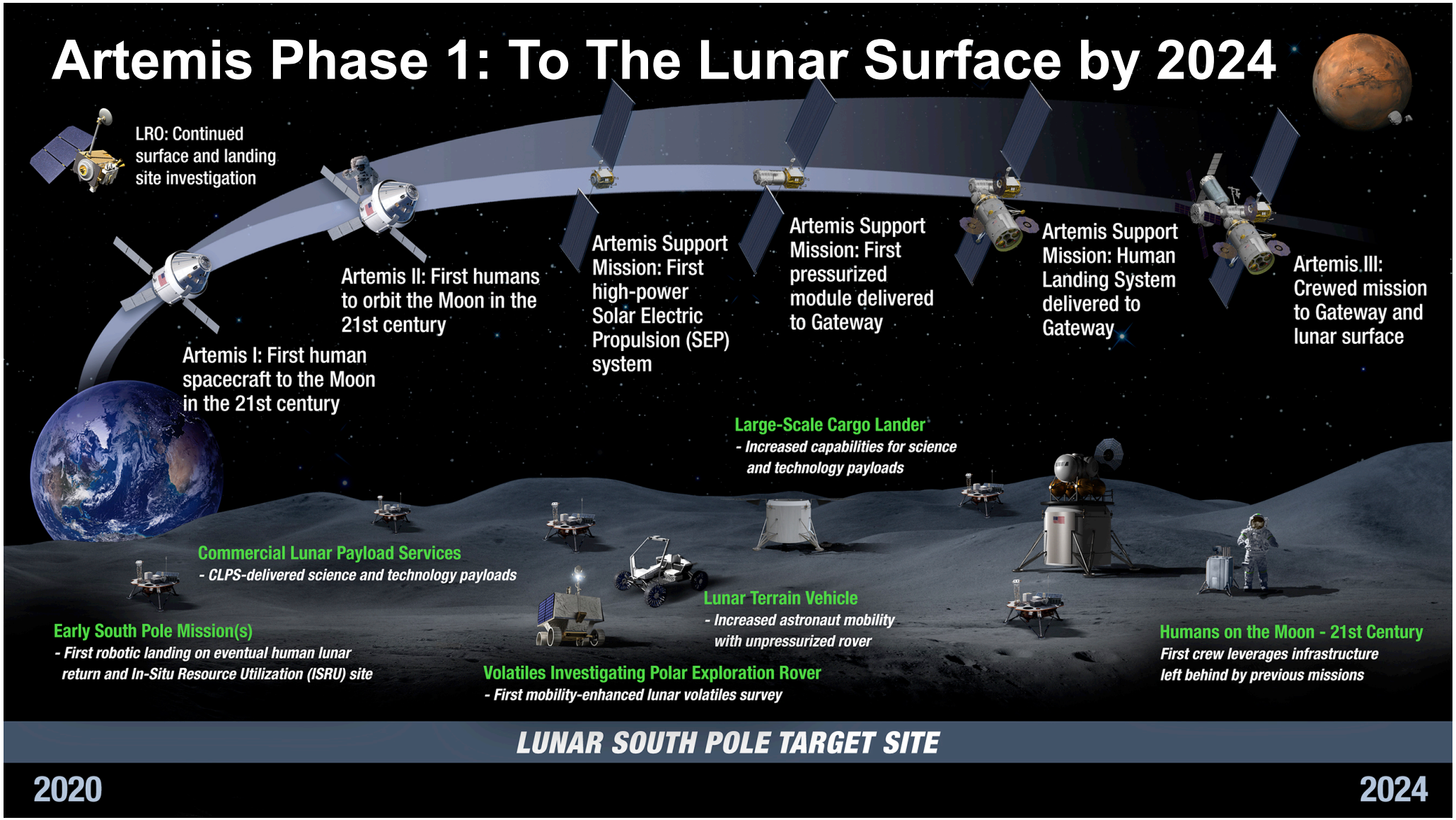
"NASA Selects First Science Instruments to Send to Gateway"

- The complement of instruments between the two packages provides a spectrum of measurements of the cis-lunar radiation environment
- Summary of major science objectives:
  - Provides space weather and radiation measurements characterizing the environment beyond LEO
  - Long-term objectives include predictive techniques that can be used for protection of future Mars crews
  - In coordination with existing Heliophysics spacecraft already in lunar orbit, the Gateway observations will allow coordinated science not previously possible:
    - Solar Energetic Particle Source and Acceleration Mechanisms
    - Solar Wind Structures - resolving 3D solar wind structures at small scales witnessed in GCR variability
    - Magnetosphere dynamics from a location unaffected by Earth's strong dipole
  - Flying through the Earth's radiation belts builds on science from the Van Allen Probes mission
- The NASA-led Heliophysics Package will be developed by NASA/GSFC Explorers and Heliophysics Projects Division (EHPD)
- The ESA-led Radiation Package will be developed by ESA/European Space Research and Technology Centre (ESTEC)

Science Strategy at the Moon: A Bold New Era of Human Discovery

- The Moon is:
  - A cornerstone for Solar System science and for exoplanet studies
  - A natural laboratory to study planetary processes and evolution, and a platform from which to observe the Universe
  - A critical location to understand volatiles cycles and study impact history of the Earth-Moon system
  - A record of the ancient Sun
- Conducting scientific exploration synergistically with crew and robotic explorers teaches us effective techniques that can be applied as we push the boundaries of exploration to Mars and other locations in our Solar System
- An opportunity to use emplaced infrastructure and resources
- The infrastructure associated with human exploration can be leveraged to support autonomous scientific investigations.
- Science mission planning for human lunar missions continue
  - A joint SMD/HEOMD/STMD workshop was planned for April 2020 to discuss the science enabled by crews going to the south polar region; postponed due to travel restrictions implemented with continuing coronavirus spread

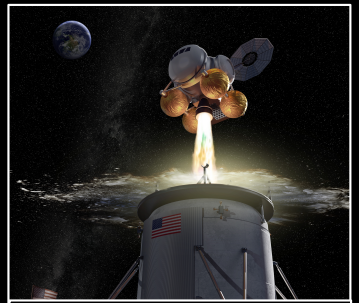

National Aeronautics and
Space Administration
NASA
Artemis
Moon to Mars Overview
Jacob Bleacher
Chief Exploration Scientist (acting)
HEOMD Advanced Exploration Systems
NASA Headquarters
www.nasa.gov


Artemis Phase 1: To The Lunar Surface by 2024
LRO: Continued surface and landing site investigation
Artemis I: First human spacecraft to the Moon in the 21st century
Artemis II: First humans to orbit the Moon in the 21st century
Artemis Support Mission: First high-power Solar Electric Propulsion (SEP) system
Artemis Support Mission: First pressurized module delivered to Gateway
Artemis Support Mission: Human Landing System delivered to Gateway
Artemis III: Crewed mission to Gateway and lunar surface
Large-Scale Cargo Lander
- Increased capabilities for science and technology payloads
Commercial Lunar Payload Services
- CLPS-delivered science and technology payloads
Early South Pole Mission(s)
- First robotic landing on eventual human lunar return and In-Situ Resource Utilization (ISRU) site
Lunar Terrain Vehicle
- Increased astronaut mobility with unpressurized rover
Volatiles Investigating Polar Exploration Rover
- First mobility-enhanced lunar volatiles survey
Humans on the Moon - 21st Century
First crew leverages infrastructure left behind by previous missions
LUNAR SOUTH POLE TARGET SITE
2020
2024

Common Moon/Mars Systems and Operations

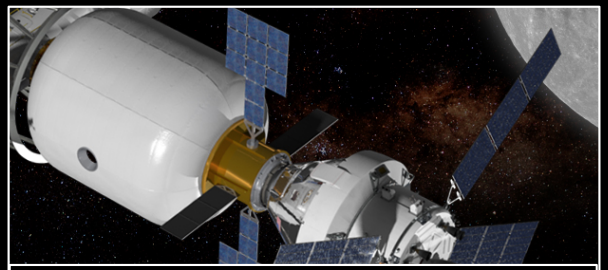
MOBILITY

SUITS

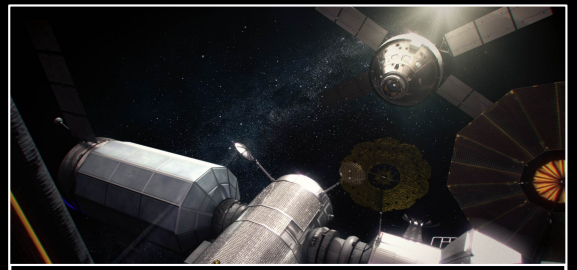


ASCENT SYSTEMS

PROPULSION



HABITATION SYSTEMS



DEEP SPACE AGGREGATION

OPERATIONS:

- Orbiting outpost with landing system
- Scientific exploration of a planetary surface
- Automation and robotics to assist/maximize human-led science
- End-to-end dust mitigation
- Physical and behavioral health operations
- Communications & Navigation
- Power systems


EXPLORE
with us